

CLAIMS:

1. A rig for drilling a well comprising:

a base;

a mast mounted on said base;

5 a top drive operable to engage and rotate downhole equipment, slidably mounted on said mast for longitudinal sliding along said mast; and

a coiled tubing injector operable to move coiled tubing in and out of said well, mounted on said mast such that  
10 the coiled tubing injector may be selectively transposed between a first position in which the injector is in line with the mast, to a second position in which the injector is out of line with the mast to accommodate manipulation of down-hole equipment by the top drive.

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2. The rig of claim 1 wherein said rig further comprises:

a rotary table operable to engage and rotate downhole equipment, mounted on said base in line with said mast.

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3. The rig of claim 2 wherein said coiled tubing injector is in a fixed position along the length of said mast.

4. The rig of claim 3 wherein said coiled tubing  
25 injector is mounted on said mast by means of:

rails mounted substantially perpendicular to the mast;

a dolly mounted on said rails for linear movement along said rails; and

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said coiled tubing injector mounted on said dolly.

5. The rig of claim 1 wherein said rig further comprises:

a winch mounted on said mast for controlling, in association with a cable wound on said winch and attached to said top drive, the longitudinal sliding movement of said top drive along said mast.

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6. The rig of claim 1 wherein said top drive includes:  
a threaded engagement element for threaded engagement with downhole equipment; and

a pivotal engagement element pivotally mounted below  
10. said rotational engagement element to permit engagement of downhole equipment which is not in line with the mast,  
wherein said pivotal engagement element is adapted to allow downhole equipment to pass therethrough to engage the rotational engagement element when said downhole equipment is  
15 in line with said mast, and upward force is exerted on the downhole equipment.

7. The rig of claim 1 wherein said rig further comprises:

20 a storage reel spindle mounted on said base for accommodating rotational mounting of a coiled tubing storage reel;

a storage reel drive mounted on said base for rotating said coiled tubing storage reel; and

25 a guidance system for guiding coiled tubing off of, and on to the coiled tubing storage reel.

8. The rig of claim 1 wherein said mast is pivotally mounted on said base, said rig further comprising:

30 tilt-control means for controlling the angle of the mast so as to accommodate off-vertical drilling.

9. The rig of claim 1 wherein said base is a wheeled carrier.

10. The rig of claim 9 wherein said mast is pivotally  
5 mounted on said base, said rig further comprising:

tilt-control means for controlling the angle of the mast so as to move the mast from a transportation position in which the mast is substantially parallel to the carrier, and an operating position in which the mast is substantially parallel  
10 to the well.

11. The rig of claim 9 wherein said rig further comprises:

retractable stabilizing legs mounted on said base for  
15 stabilizing said base relative to the ground, said stabilizing legs being retractable from an operating position in which the stabilizing legs are in contact with the ground, and a transportation position in which said stabilizing legs are lifted out of contact with the ground.

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12. The rig of claim 11 wherein said stabilizing legs have mounted at their ends, pontoons.

13. The rig of claim 1 wherein said rig further  
25 comprises:

blow-out-preventer hangers mounted on said rig in line with said mast for lowering and lifting a blow-out-preventer on to and off of a wellhead.

30 14. The rig of claim 1 wherein said coiled tubing injector has mounted there-below a lubricator for guiding the coiled tubing, wherein said lubricator is telescoping to selectively allow access to said coiled tubing.

15. The rig of claim 2 wherein said top drive, coiled tubing injector and rotary table are adapted to assemble a bottom hole assembly.

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16. The rig of claim 1 wherein said rig is adapted to selectively drill using coiled tubing and jointed-pipe.

17. A BHA (bottom hole assembly) assembling system for  
10 assembling a BHA for use in coiled tubing drilling, said BHA assembling system comprising:

a base;

a mast mounted on said base;

15 a top drive operable to engage and rotate BHA elements, slidably mounted on said mast for longitudinal sliding along said mast;

a coiled tubing injector operable to move coiled tubing on to and off of a BHA, mounted on said mast such that the coiled tubing injector may be selectively transposed  
20 between a first position in which the injector is in line with the mast, to a second position in which the injector is out of line with the mast to accommodate manipulation of BHA elements by the top drive; and

a rotary table operable to engage and rotate BHA  
25 elements, mounted on said base in line with the mast.

18. The BHA assembling system of claim 17 wherein said coiled tubing injector is in a fixed position along said mast.

30 19. The BHA assembling system of claim 17 wherein said coiled tubing injector is mounted on said mast by means of:  
rails mounted substantially perpendicular to the mast;

a dolly mounted on said rails for linear movement along said rails; and  
said coiled tubing injector mounted on said dolly.

5 20. The BHA assembling system of claim 17 wherein said BHA assembling system further comprises:

a winch mounted on said mast for controlling, in association with a cable wound on said winch and attached to said top drive, the longitudinal sliding movement of said top  
10 drive along said mast.

21. The BHA assembling system of claim 17 wherein said top drive includes:

a threaded engagement element for threaded engagement  
15 with downhole equipment; and

a pivotal engagement element pivotally mounted below said rotational engagement element to permit engagement of downhole equipment which is not in line with the mast,

wherein said pivotal engagement element is adapted to  
20 allow downhole equipment to pass therethrough to engage the rotational engagement element when said downhole equipment is in line with said mast, and upward force is exerted on the downhole equipment.

25 22. The BHA assembling system of claim 17 wherein said BHA assembling system further comprises:

a storage reel spindle mounted on said base for accommodating rotational mounting of a coiled tubing storage reel; and

30 a storage reel drive mounted on said base for rotating said coiled tubing storage reel.

23. The BHA assembling system of claim 17 wherein said coiled tubing injector has mounted there-below a lubricator for guiding the coiled tubing, wherein said lubricator is telescoping to selectively allow access to said coiled tubing.

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24. The BHA assembling system of claim 17 wherein said base is a wheeled carrier.

25. The BHA assembling system of claim 24 wherein said mast is pivotally mounted on said base, said BHA assembling system further comprising:

10 tilt-control means for controlling the angle of the mast so as to move the mast from a transportation position in which the mast is substantially parallel to the carrier, and an operating position in which the mast is substantially parallel to a well to be drilled.

26. The BHA assembling system of claim 24 wherein said BHA assembling system further comprises:

20 retractable stabilizing legs mounted on said base for stabilizing said base relative to the ground, said stabilizing legs being retractable from an operating position in which the stabilizing legs are in contact with the ground, and a transportation position in which said stabilizing legs are lifted out of contact with the ground.

27. The BHA assembling system of claim 26 wherein said stabilizing legs have mounted on their ends, pontoons.

30 28. The BHA assembling system of claim 17 wherein said BHA assembling system is also adapted to drill a well.

29. The BHA assembling system of claim 28 wherein said mast is pivotally mounted on said base, said BHA assembling system further comprising:

5 tilt-control means for controlling the angle of the mast so as to accommodate off-vertical drilling.

30. The BHA assembling system of claim 28 wherein said BHA assembling system is adapted to selectively drill using coiled tubing and jointed-pipe.

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31. A method of assembling a plurality of threaded BHA (bottom hole assembly) elements into a BHA for use in coiled tubing drilling, each of said BHA elements having an upper end and a lower end, said method using a BHA assembling system

15 having:

a base;

a mast mounted on said base;

a top drive operable to engage and rotate BHA elements, slidably mounted on said mast for longitudinal sliding along said mast;

20 a coiled tubing injector operable to move coiled tubing on to and off of a BHA, mounted on said mast such that the coiled tubing injector may be selectively transposed between a first position in which the injector is in line with the mast, to a second position in which the injector is out of line with the mast to accommodate manipulation of BHA elements by the top drive; and

a rotary table mounted on said base in line with the mast, operable to engage and rotate BHA elements,

30 said method comprising:

a) transposing the coiled tubing injector to its second position in which the injector is out of line with the mast;

b) sliding the top drive to a position along the mast in spaced relation to the rotary table;

c) placing a bottom element of the BHA into the rotary table;

5 d) operating the rotary table to engage the bottom element of the BHA;

e) placing a second element of the BHA such that its upper end is adjacent to the top drive;

f) operating the top drive to engage the second element  
10 of the BHA;

g) positioning the second element such that its lower end is adjacent to the upper end of the bottom element of the BHA;

h) operating said top drive and/or said rotary table to  
15 rotate the second element and/or the bottom element relative to each other so as to screw the two elements together;

i) operating the top drive to disengage the second element of the BHA;

j) sliding the top drive along the mast to a position in  
20 spaced relation to the second element;

k) repeating steps e) through j) for the remaining elements of the BHA;

l) sliding the top drive along the mast to a position above the coiled tubing injector;

25 m) transposing said coiled tubing injector to its first position in which the injector is in line with the mast;

n) operating said coiled tubing injector to move coiled tubing having a threaded end, to a position adjacent the assembled BHA;

30 o) operating said rotary table to rotate the BHA so as to screw the BHA onto said threaded end of the coiled tubing; and

p) operating said rotary table to disengage the BHA.



32. The method of claim 31 further comprising between steps h) and i):

h1) operating said rotary table to disengage the bottom  
5 element of the BHA;

h2) sliding the top drive down so as to insert the second element of the BHA into said rotary table; and

h3) operating said rotary table to engage the second element of the BHA.

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33. The method of claim 31 wherein the top drive of the said BHA assembly system includes:

a threaded engagement element for threaded engagement with downhole equipment; and

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a pivotal engagement element pivotally mounted below said rotational engagement element to permit engagement of downhole equipment which is not in line with the mast,

wherein said pivotal engagement element is adapted to allow downhole equipment to pass therethrough to engage the  
20 rotational engagement element when said downhole equipment is in line with said mast, and upward force is exerted on the downhole equipment,

and wherein step f) is accomplished by:

operating the pivotal engagement element to engage  
25 the second element of the BHA.

34. The method of claim 33 wherein step g) is accomplished by:

once the upper end of the second element has been  
30 engaged by the pivotal engagement element of the top drive, moving the top drive along the mast away from the rotary table until the second element is in line with the mast, and then moving the top drive toward the rotary table until the lower

end of the second element is adjacent the upper end of the bottom element.

35. The method of claim 34 wherein step h) includes:

5 first continuing to lower the top drive until the second element of the BHA passes through the pivotal engagement element and is adjacent to the threaded engagement element of the top drive, and said operation of said top drive and/or said rotary table threadedly engages the threaded engagement element  
10 of the top drive and the second element of the BHA.

36. The method of claim 31 wherein once the final BHA element has been screwed onto the other elements of the BHA using the top drive and/or the rotary table, operating the  
15 rotary table to disengage the BHA, sliding the top drive along said mast toward the rotary table so as to move the BHA partly into the well, operating the rotary table to re-engage the BHA, and then operating the top drive to disengage the final BHA element.

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